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AUTHOR Roberson, J. A.; Crowe, C. T.
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ABSTRACT

The authors developed an on-campus self-paced system of instruction featuring immediate feedback and tutoring. They then extended the technique to correspondence courses by giving examinations by telephone. Both courses are described, and the results are discussed in this publication. A Personalized System of Instruction (PSI) or Self-Paced Instruction (SPI) was developed for a course in fluid mechanics. The rationale for this curriculum innovation is presented in the paper's introduction. The experiences that the authors had with the programs and how these experiences were used in their program for off-campus education are outlined in one section of the paper. Bibliographical data are presented. (Author/EB)

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PSI + TEL = NEW HORIZONS IN CONTINUING EDUCATION

J. A. Roberson, Professor
Department of Civil and Environmental Engineering
Director, Albrook Hydraulics Laboratory
C. T. Crowe, Professor
Department of Mechanical Engineering
Washington State University
Pullman, Washington 99163

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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INTRODUCTION

In the past five years, considerable interest has been generated in engineering education circles in the Personalized System of Instruction (PSI) or sometimes called Self-Paced Instruction (SPI). Because of the high praise from many educators for this new system of instruction and because of a desire for a new experience in teaching, such a system was developed by the authors for a course in fluid mechanics.

In this system, the student receives along with a text a set of learning objectives which cover a series of mini-courses comprising the program of study. The student studies the material, works the problems, and then takes an examination for each mini-course and, if successful, proceeds to the next mini-course until the series is completed. A grade of C or D is earned when the basic core material has been mastered, and higher grades are earned by mastering more material and/or elements of the core material in greater depth. When the student needs help he consults either the instructor or student proctors who are available at scheduled times for assistance.

After the course had been tried for one semester, the authors presented a paper at a regional engineering society meeting and explained the new methods that were being used. At the end of the presentation, an engineer asked if the self-paced system differed from an ordinary correspondence course. It was explained that, "with a self-paced course, examinations are checked immediately after the student completes the exam and the instructors or proctors are available for tutoring." Thus, the two main differences between the correspondence course and the self-paced system are immediate feedback after exams and tutorial help. Since these differences are significant, the engineer's question prompted the idea that "if a means could be found to have exams in correspondence-type courses checked promptly, the self-paced instruction system could be offered off campus just as well as on campus." The telephone provides the means by which this can be done.

The telephone system developed by the authors should lower overall educational costs and at the same time offer the student alternatives to the traditional forms of education. This is especially relevant to mature adults who are interested in continuing education. If more courses could be taken by individuals at home or at their place of work rather than on campus, the cost to the student would be reduced, for example, housing and transportation costs. Capital costs at institutions would also be reduced.

Although some courses may not be suited to the system suggested here, the authors feel that virtually all major lecture courses could be so handled.

The next section outlines the experience which the authors have had with the self-paced educational programs and how it was used in their program for off-campus education.

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COURSE DEVELOPMENT

Self-Paced Courses (On Campus)

In order to explore alternatives to the traditional forms of education, the Washington State Legislature in 1970 appropriated a significant sum of money for innovative education. The authors competed for, and were awarded, grants to initiate self-paced courses in engineering mechanics at Washington State University. During the fall semester of 1970, Crain and Crowe (2) developed a self-paced course in thermodynamics. Then, in 1971, Roberson, Crowe, and Mahalingam (7) developed a self-paced individualized course of instruction in fluid mechanics. Since then the authors have had responsibility for the fluid mechanics course which is taken by students in all disciplines of engineering at Washington State University.

In the fluid mechanics course the student is given a set of objectives covering a series of mini-courses of the program of study and suggested methods of learning. Basically, this set is the student's study guide.

Following the study guide in conjunction with the text, the student proceeds in his program of study, taking examinations and performing individualized laboratory exercises on each mini-course until the series is completed. When the student needs help he either checks with the instructor or student proctors who are available for assistance. An important aspect of this course is that the student learns from mastery; he does not proceed to the second mini-course until mastering the first, etc. Thus, the instructor is no longer an adversary; he is in the role of helping the student master the material which is spelled out in the objectives. Rapport between student and instructor is enhanced because of this change in relationship. Additional information concerning "on-campus" self-paced instruction in fluid mechanics is given by Roberson and Crowe (6).

As a point of interest, the authors' initiation to the self-paced approach to learning occurred through the activities of the American Society for Engineering Education, in the short courses and workshops which it sponsored. These short courses focused on learning-for-mastery principles and drew upon the experiences of Bloom (1), Keller (3), Koen (4), Mager (5), and Skinner (8).

Off-Campus Instruction

Because normal lectures are not a part of the methods of instruction noted above, and because each student pursues the course of study at his own pace, the authors felt that this mode of instruction would also be adaptable for off-campus instruction. Thus, when the opportunity arose, it was tested. Because one student had an incomplete in the on-campus self-paced course at the end of the semester, he later completed the course off campus during the summer using the self-paced format. However, during that period, tutoring and administering of examinations were done by telephone. The instructors and student all concluded that this mode of instruction had definite potential for other off-campus instruction. Since then, the telephone technique has been used with other students. Two of the students, employees engaged in engineering work some 200 miles from the campus, took the course as a form of continuing education.

Telephone Examinations

A major strength of the learning-for-mastery approach to education is that the student has immediate feedback on examinations because the exams are graded immediately. The major weaknesses of a normal correspondence-type course are: 1) the feedback time is very slow, and 2) the student feels little, if any, personal contact with the instructor. By administering examinations by telephone for off-campus instruction, both personal contact and immediate feedback are accomplished.

The off-campus student has the same textbook and printed materials as the on-campus student. In addition, the off-campus student receives sealed envelopes for each mini-course, every one containing a different examination. He is directed by the instructor over the phone to open only one envelope which contains the exam he is to work at that time. Then the student works the exam and after the allotted time the instructor calls the student and grades it over phone. Upon checking the exam, if the instructor senses deficiencies in the student's work, these deficiencies are discussed and a new time for the next exam period is arranged. The student then sends the completed exam back to the instructor for filing. Immediate feedback has been achieved--a condition not attainable in the normal correspondence-type course.

Upon completion of all of the mini-courses, the student sends all of the unused exams in the sealed envelopes back to the instructor along with completed exams; thus, the student does not have access to the exams that were not used.

RESULTS

Effectiveness of Telephone Testing

As a result of working with students with diverse background and an age span from 22 to 50 years, the authors are convinced that the overall results using the self-paced approach and an off-campus environment are just as effective as with an on-campus course—if not more so. The telephone testing did not present any problems different from those on campus. Since the instructors had their own solutions to the examinations for checking procedures and answers, they could easily follow and evaluate the student's approach by telephone communication. The sealed-envelope technique of ensuring security of examinations also proved effective.

A procedure which had to be followed in the off-campus routine was that of keeping accurate notes of each phone conversation to maintain a complete record of achievement and to note future telephone testing or tutoring appointments. This complete running account of each student's progress is retained for later reference.

Along with notes of progress and achievement, the length of time for each telephone communication was recorded. Analyses of the number and length of calls indicated that an average of 40 calls per student were made for the three-semester-hour course and that these calls varied in length from one minute to 35 minutes with the average length of call being about 10 minutes.

Based upon SCAN rates for Washington state, the total telephone bill ran between $25 and $30 per student, which was much less than had originally been anticipated.

Personal Contact--A Positive Factor

Students who enrolled in the course as part of their continuing education program indicated that this course procedure was much superior to the normal correspondence-type extension course. They remarked that the personal contact, although by phone, made them feel like real live students instead of just names or numbers. They also appreciated the opportunity for dialogue over particularly interesting or difficult points. The authors think this aspect is most important for older, more experienced students interested in continuing education because of their special areas of interest into which they want to delve deeper than would the normal undergraduate on-campus student.

Motivation from Prearranged Scheduling

As already noted, the telephone testing procedure required that the instructor and student establish a future telephone communication date after each examination so that time would not be wasted in trying to make calls when either one or the other was not in his office.* The students said this was a very positive factor when compared to the normal correspondence course, because they were going to make personal contact with the instructor and were determined to be prepared.

Cost Analysis

An analysis of the time an instructor spends on the off-campus, self-paced course indicates that he spends about twice as much time per student as he does for a conventional lecture-discussion-type course. Therefore, no savings can be claimed if one compares costs for full-time students. However, for the adult who has a job and wants to further his education by enrolling in only one or two courses at a time, the self-paced system using telephone testing is much more economical. The student can learn while he earns. He saves time, too, because he is not required to commute "across town" to attend evening lectures. Of course, the tuition for correspondence courses is usually much less than the instructor's costs plus telephone costs indicated here; but in light of positive student opinion using the telephone procedure, there is no comparison between the two systems as far as learning achievement and student satisfaction are concerned.

FUTURE POSSIBILITIES

The off-campus self-paced system of instruction can be used with a variety of courses. However, it appears to be most advantageous in specialized areas where only a few individuals have the background to effectively teach the course

*The continuing education students took their examinations or had telephone tutoring sessions during the day at their place of work, either at noon or near a normal break period.

material, and a relatively small number of people in the given geographical area are interested in taking the course. By using the self-paced course system with telephone testing and tutoring, only one or two instructors need offer the course to all interested people within, perhaps, the entire U.S. Therefore, this system seems especially suited for continuing education.

The system, however, need not be limited to such specialized courses. To serve as an alternative form of an educational system may be reason enough for its use. It can be used by students for which the on-campus type of instruction is undesirable or infeasible. For example, some students may be enrolled at community colleges where the advanced or professionally oriented courses are not offered. The student could take a combination of community college courses and self-paced courses, decreasing by a year the length of time required for residency at a university. In addition, some regular university students may wish to take these courses in the summer while working or participating in work-study programs. Students who might otherwise be inclined to enroll in correspondence courses would probably find the self-paced system to be much more effective. This would include women who are "tied down" at home. Other possible enrollees in such courses include military personnel and transients, such as traveling salesmen, migrant workers, and construction workers.

CONCLUSIONS

The potential for off-campus instruction afforded by self-paced courses using telephone communication is unlimited. Any individual with access to a telephone can enroll in such a course and have the same direct communication with the instructor available to his on-campus counterpart. This mode of instruction provides the major advantage of on-campus instruction to off-campus students--a correspondence course without correspondence!

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